Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/jpfa



Comparative evaluation of intrusive effects of miniscrew, Connecticut intrusion arch, and utility intrusion arch – An in vivo study

Ashutosh Kaushik, Maninder Singh Sidhu, Seema Grover *, *Sandeep Kumar*

Department of Orthodontics and Dentofacial Orthopedics, S.G.T. Dental College, Hospital and Research Institute, Budhera, Gurgaon, Haryana 122505, India

ARTICLE INFO

Article history:
Available online 9 February 2016

Keywords:
Utility arch
Connecticut arch
Deep bite
Miniscrews

ABSTRACT

Objectives: This study compared the skeletal and dental changes obtained by incisor intrusion using three methods: utility intrusion arch (UIA), Connecticut intrusion arch (CIA), and miniscrews.

Materials and methods: A total of thirty-eight patients with age range of 14–25 years were included which were divided into three groups: Group I ($n = 13$), UIA; Group II ($n = 13$), CIA; and Group III ($n = 12$), miniscrew. All the groups were further subdivided into maxillary and mandibular arch. Intrusion force of 60 g and 40 g was used for maxillary and mandibular arch respectively for standardization. Intrusion was concluded after 5–6 months or when correction was achieved. Pre-treatment and post-treatment skeletal and dental changes were compared sing lateral cephalograms.

Results: The results suggested that all three methods were effective means of intrusion, but true intrusion measured from center of resistance was maximum in miniscrew group. No anchorage loss and change in axial inclination of incisors was observed in miniscrew group as compared to UIA and CIA group. Overbite decreased in all groups but more significantly in miniscrew group.

Conclusions: Miniscrew intrusion was considered the preferred method of true intrusion to correct deep bite.

© 2016 Pierre Fauchard Academy (India Section). Published by Elsevier, a division of Reed Elsevier India, Pvt. Ltd. All rights reserved.

1. Introduction

Deep bite is one of the most common findings in cases of malocclusion. Deep bite by definition means increased overbite and is measured as vertical overlap of the incisors perpendicular to the occlusal plane (OP). It is typically corrected by intrusion of the anterior teeth or extrusion of the posterior teeth or both. The treatment of choice depends on a variety of factors such as incisor display, smile line, and vertical dimension. The decision must be based on patient's age, etiology of the anomaly, skeletal and dental morphology, surrounding muscular and periodontal tissues, existence of the deep bite in the rest position, length of lips, OP, ideal incisor position, and the lower facial height.

An excessive deep bite is associated with incisor wear, palatal impingement, and compromised esthetics[1] and potentially detrimental effects on temporomandibular joint

* *Corresponding author*. Tel.: +91 9810636828.
E-mail address: seemaortho@gmail.com (S. Grover).

http://dx.doi.org/10.1016/j.jpfa.2016.01.001

0970-2199/© 2016 Pierre Fauchard Academy (India Section). Published by Elsevier, a division of Reed Elsevier India, Pvt. Ltd. All rights reserved.

function and periodontal health. Deep overbite correction is often a major component of orthodontic treatment. The treatment for patients with normal vertical development and gummy smiles involves maxillary incisor intrusion. Intrusion is also the treatment of choice for adult patients who have significant bone loss around the incisors.

Intrusion of incisors is an ideal option to correct deep bites because it maintains the vertical dimension of the patient. Successful intrusion mechanics include force magnitude constancy, use of single point application, control of direction of force and selection of proper point of force application, and control of reactive units avoiding extrusive mechanics, which should be carefully planned and delivered. Conventional methods of incisor intrusion usually involve 2 × 4 appliances such as utility arches, 3-piece intrusion arches, or reverse curved arches. An intrusive force is applied to the incisors using tip-back bends at the molars. Engaging the utility arch will produce approximately 15 g of force on each incisor, a force level considered ideal for lower incisor intrusion.

Nanda's Connecticut intrusion arch[2] (CIA) is fabricated from a nickel titanium alloy to provide the advantages of shape memory, springback, and light, continuous force distribution. When arch is activated, a simple force system results, consisting of a vertical force in the anterior region and a moment in the posterior region.

The introduction of skeletal anchorage (miniscrews) as a source of stationary anchorage to orthodontic forces has made most complex tooth movements simple.[3] Mini implants have been used to intrude incisors since 1983, when Creekmore and Eklund reported using a metal implant to correct a deep overbite.[4,5] It has been shown that miniscrews can be loaded to forces up to 500 g and yet stay intact until the end of the treatment. It has been shown that true intrusion can be achieved with simple mechanics via miniscrews with only minimal protrusion of the anterior teeth.

In this study, we aimed to compare dental and skeletal changes obtained by incisor intrusion obtained with the aid of utility arch, CIA, and miniscrews.

2. Materials and method

The sample size consisting of 38 subjects in the age group between 14 and 25 years was selected from patients coming to the department of orthodontics who were recommended orthodontic treatment. The inclusion criteria for the study were: patients having deep bite of at least 4 mm, with minimal crowding and no existing history of periodontal disease. The exclusion criteria were teeth with incomplete apexification, history of trauma, signs of root resorption prior to orthodontic treatment, history of root canal treatment, and previous orthodontic treatment.

In this study, comparison of intrusive effects of utility intrusion arch (UIA), CIA, and miniscrews were evaluated for deep bite correction using lateral cephalograms. Fixed orthodontic treatment was started in all the patients utilizing MBT™ Versatile+ Appliance System prescription with 0.022 × 0.028 slot.

The patients were divided randomly into three groups based on treatment mechanics: Group I consisted of 13 patients ($n = 13$), with maxillary arch ($n = 7$) and mandibular arch ($n = 6$), where intrusion was achieved by UIA. Group II consisted of 13 patients ($n = 13$), with maxillary arch ($n = 7$) and mandibular arch ($n = 6$), where intrusion was achieved by CIA. Group III consisted of 12 patients ($n = 12$), with maxillary arch ($n = 7$) and mandibular arch ($n = 5$), where intrusion was achieved by miniscrews.

In all the three groups, intrusion was carried out in either maxillary incisors, mandibular incisors, or both as dictated by the clinical situation. The intrusive force of 60 g and 40 g was used in maxillary and mandibular arch respectively for standardization. The force was measured by dontrix gauge. Intrusion was concluded after 5–6 months or when the correction was achieved. For the assessment of true intrusion, the evaluation was made from the center of resistance of incisor rather than the incisor apex or the crown tip, as it may lead to the perception of intrusion due to the inclination changes achieved during the intrusion.

All patients were evaluated every 3 weeks. A logbook was maintained to keep record of all patients at every visit. The force chosen in the present study for intrusion was 15 g per maxillary incisor and 10 g per mandibular incisor and same force was maintained for all three groups at each visit.

2.1. *Group I (utility arch group)*

Custom made utility arches were made from 0.016 in. × 0.022 in. blue elgiloy wire (RMO). The UIAs were constructed according to the specifications given by Ricketts.[6] Before the placement of the utility arch, a 45° tip back to molar section was given, directly ligated into the anterior bracket slots and the arch was cinched back.

2.2. *Group II (CIA group)*

The CIA is a proprietary trademark of Ortho Organizer, San Marcos, CA 92069, a pre-fabricated intrusion arch. The CIA was fabricated from 0.016″ × 0.022″ dimension nickel titanium alloy to provide advantages of shape memory, springback, and light continuous force distribution. The maxillary and mandibular versions have anterior dimensions of 34 mm and 28 mm respectively.[2] The intrusion arch was directly ligated into the anterior bracket slots and cinched back.

2.3. *Group III (miniscrews group)*

Two miniscrews (Biomaterials®, Korea), 1.3 mm in diameter and 8 mm in length were placed between the roots of lateral incisor and canine under local anesthesia. Standard periapical radiographs were taken to check the position of the screws in relation to neighboring roots. The screws were loaded after at least 1 week of placement with medium superelastic nickel titanium closed coil springs of appropriate length and an intrusion force of 50–80 g was applied. Control appointments were kept every 4 weeks and the force was checked at every appointment. Records were taken before the application of the mechanics and after completion of intrusion. All the patients were radiographed by using digital lateral cephalograms.

To avoid the perception of false intrusion, the center of resistance of maxillary central incisor was taken as point

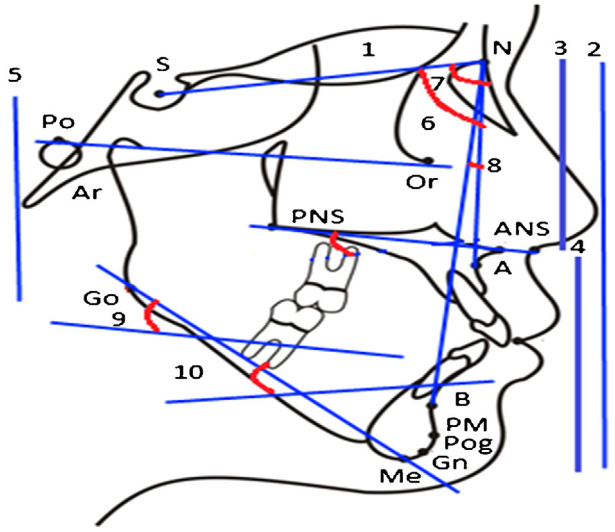


Fig. 1 – Cephalometric parameters: (1) sella-nasion distance, (2) anterior facial height, (3) upper facial height, (4) lower facial height, (5) posterior facial height, (6) SNA, (7) SNB, (8) ANB, (9) MP–FH, and (10) MP–SN.

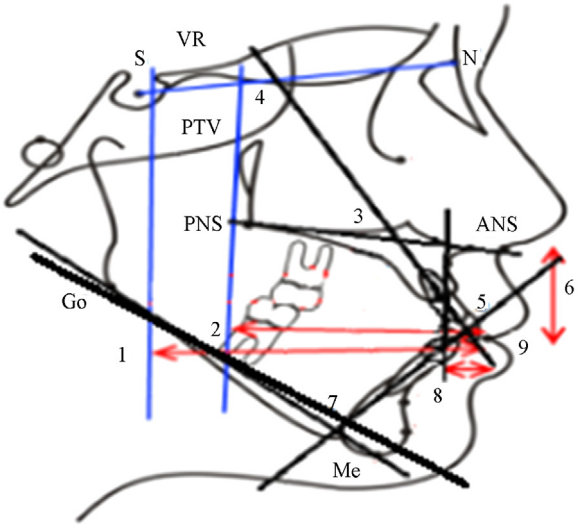


Fig. 2 – Cephalometric parameters: (1) U1-VR, (2) U1-PTV, (3) U1-PP, (4) U1-SN, (5) U1-L1, (6) U1Cr-PP, (7) L1-MP, (8) overjet, and (9) overbit.

located at one third of distance of root length apical to alveolar crest. The center of resistance (Cr) of the maxillary incisor was selected as a measurement point instead of the Cr of the anterior segment because it is easier to locate and more reproducible. Lateral cephalometric parameters were evaluated for hard and soft tissues changes that occurred by intrusion in all the patients.

To measure linear cephalometric parameters, following planes were used as reference planes for accurate measurements:

1. Pterygoid vertical (PTV): the PTV drawn perpendicular to sella-nasion plane passing through posterior superior of Pterygomaxillary Fissure.
2. Vertical reference plane (VR): drawn perpendicular to constructed horizontal plane (7° to SN plane) from point of intersection of anterior wall of sella turcica and anterior clinoid process.

Sella-nasion (SN), Frankfort horizontal (FH), mandibular plane (MP), palatal plane (PP), and occlusal plane (OP) were also used as reference planes in this study. The cephalometric hard tissue skeletal linear and angular parameters measured were: (1) sella-nasion distance, (2) anterior facial height, (3) upper facial height, (4) lower facial height, (5) posterior facial height, (6) SNA, (7) SNB, (8) ANB, (9) MP–FH, and (10) MP–SN (Fig. 1). The cephalometric hard tissue dental angular and linear parameters measured were (1) U1-VR, (2) U1-PTV, (3) U1-PP, (4) U1-SN, (5) U1-L1, (6) U1Cr-PP, (7) L1-MP, (8) overjet, and (9) overbite (Fig. 2).

Cephalometric superimpositions of utility arch group (Group I), Connecticut arch group (Group II), and miniscrew group are shown in Fig. 3a–c; Fig. 4a–c, and Fig. 5a–c respectively.

The data were entered into Microsoft Excel 2007 (Microsoft, Redmond, Wash). The data were analyzed using Statistical software SPSS version 16.0. For comparison of pre-treatment and post-treatment parameters, results were analyzed in subgroup, using paired *t*-test. To compare intergroup changes, one-way ANOVA was used followed by post-hoc test (post-hoc analysis, bonferroni). For comparison of subgroups along with interaction effect, two-way ANOVA was used.

3. Results

In all patients, intrusion was carried out after minimal leveling and aligning. Pre-intrusion and post-intrusion lateral head cephalograms were taken and analyzed. Following were the results obtained after evaluating skeletal and dental parameters in maxilla and mandible. Table 1 represents pre- and post-treatment cephalometric skeletal and dental parameters in maxillary and mandibular arch.

There was statistically insignificant correlation in cephalometric skeletal parameters in maxillary arch on intragroup comparison in utility arch, Connecticut arch, and miniscrew group (Table 2). Only Connecticut arch group showed significant increase in posterior facial height (1.33, $p \leq 0.05$) and MP angle (1.10, $p \geq 0.05$). In dental parameters, maxillary incisor to vertical reference (U1-VR) was significantly increased for CIA group (1.26, $p = 0.022$) and UIA group (2.42, $p \leq 0.05$). Similarly, U1-PTV was significantly increased for CIA group (1.54, $p \leq 0.05$) and UIA group (1.44, $p \leq 0.001$).

U1 CR-PP (Cr to PP) was decreased by 2.46, $p \leq 0.001$ in MS group, 1.84, $p \leq 0.001$ in CIA group, and 1.99, $p \leq 0.001$ in UIA group, all of which were statistically significant. L1-MP (°) was increased in all the three groups but the change was significant in UIA group (3.833, $p \leq 0.05$). Overbite was reduced in all the groups which was statistically significant, with 4.14 in MS group, 3.20 in CIA group, and 2.99 in UIA with $p \leq 0.001$ in

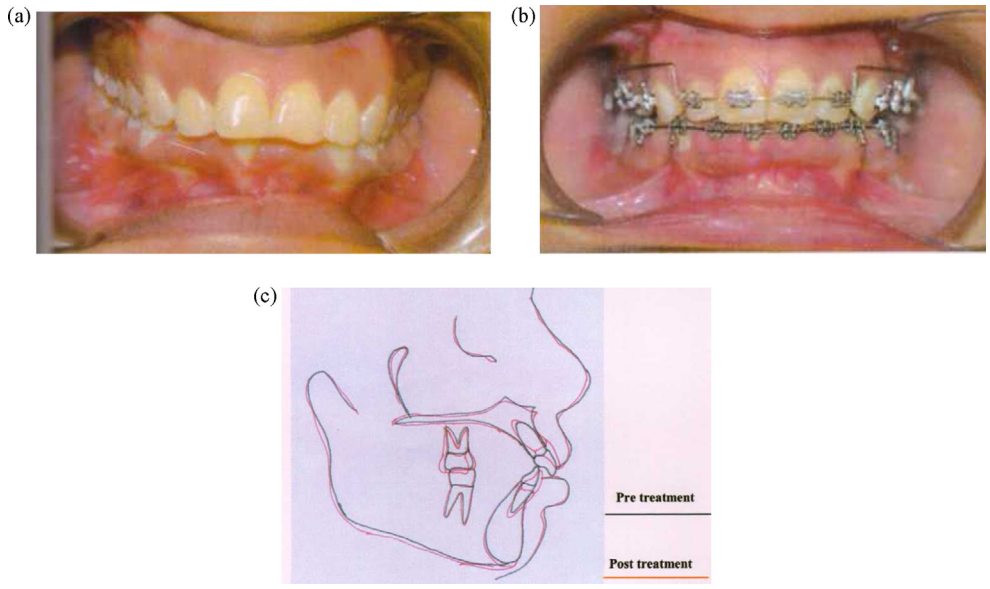


Fig. 3 – Intrusion in utility arch group (Group I). (a) Pre-treatment, (b) post-intrusion and (c) superimposition of pre-treatment and post-intrusion.

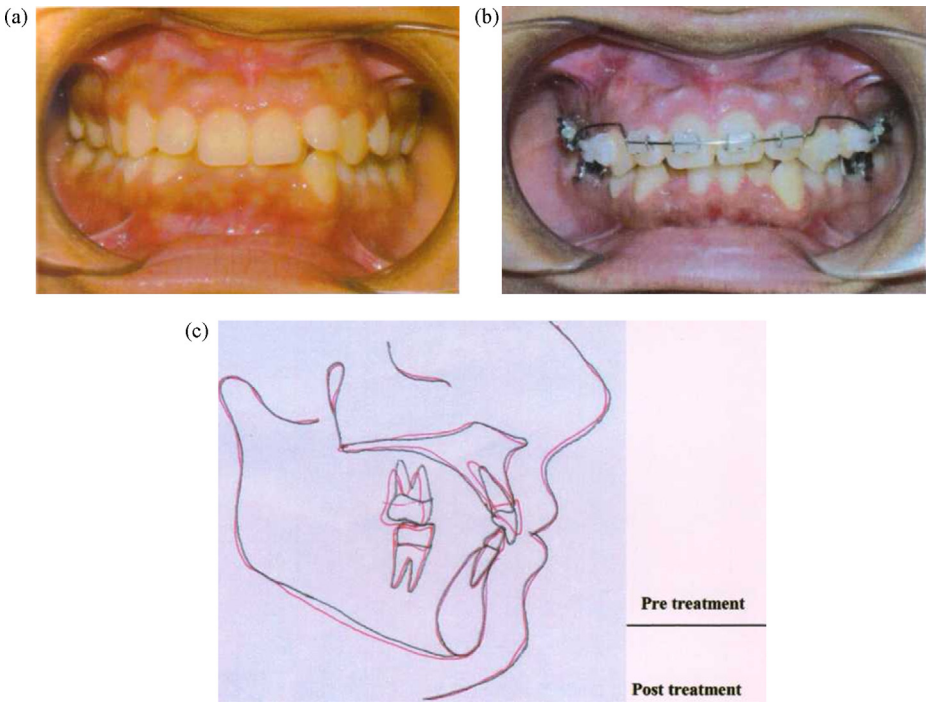


Fig. 4 – Intrusion in Connecticut intrusion arch group (Group II). (a) Pre-intrusion, (b) post-intrusion and (c) superimposition of pre-treatment and post-intrusion.

all the groups. In mandible, only in MS group, MP angle decreased whereas it slightly increased in CIA and UIA groups (Table 2).

Table 3 describes the intergroup comparison of all 3 groups in maxillary arch and no significant cephalometric skeletal and dental changes were observed except upper incisor to SN was significant when UIA and CIA were compared and also among UIA and MS groups. Also L1-MP correlation was significant when UIA vs MS groups and CIA vs MS groups were compared with each other.

4. Discussion

Recently, the focus of the orthodontic literature has been on the incisor display during smiling after treatment of deep

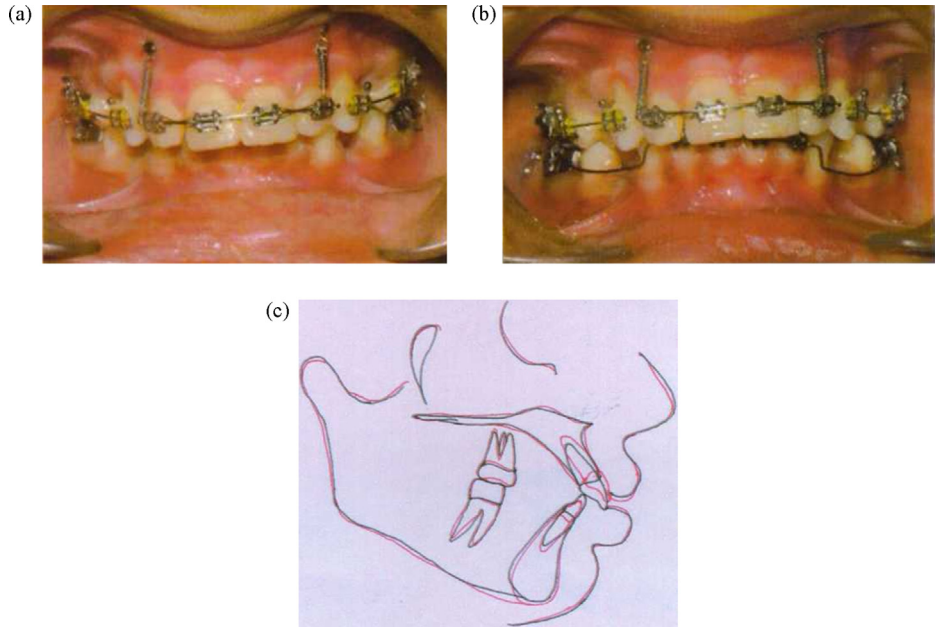


Fig. 5 – Intrusion in mini implant group (Group III). (a) Pre-treatment, (b) post-intrusion and (c) superimposition of pre-treatment and post-intrusion.

Table 1 – Comparison of pre- and post-treatment cephalometric skeletal and dental parameters for maxillary and mandibular arch in utility intrusion arch (Group I), Connecticut intrusion arch (Group II), and miniscrew (Group III).

S. No	Cephalometric parameters	Group I (UIA) ($n = 7$)				Group II (CIA) ($n = 7$)				Group III (MS) ($n = 7$)			
		Pre-treatment		Post-treatment		Pre-treatment		Post-treatment		Pre-treatment		Post-treatment	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Sella-nasion (mm)	58.51	1.51	58.68	1.52	56.33	1.85	56.43	1.99	58.50	3.15	58.43	3.21
2	AFH (mm)	91.07	4.06	94.67	7.08	89.14	1.88	92.67	4.12	96.28	6.29	95.41	6.62
3	UFH (mm)	72.60	7.40	42.93	2.55	74.20	6.46	40.76	3.07	40.75	1.92	40.71	2.06
4	LFH (mm)	50.54	5.08	54.50	8.47	51.16	2.95	51.91	3.17	52.34	5.12	53.14	5.52
5	PFH (mm)	61.05	6.23	61.64	6.33	62.44	3.11	63.77	3.54	61.16	1.81	62.01	1.34
6	SNA (°)	81.79	2.71	81.64	1.84	82.57	1.99	83.29	2.56	82.00	3.42	82.07	2.86
7	SNB (°)	76.86	3.29	77.36	2.78	76.86	1.86	78.00	2.52	76.71	2.93	76.64	2.84
8	ANB (°)	4.93	2.21	4.29	2.50	5.71	1.25	5.29	0.95	5.29	1.80	5.43	1.51
9	MP–FH (°)	24.29	4.19	24.83	4.53	22.57	1.99	23.67	2.27	18.57	5.88	17.43	5.68
10	MP–SN (°)	32.00	5.92	33.31	6.18	29.71	3.40	30.91	2.80	25.43	6.50	25.00	4.90
11	U1-VR (mm)	57.58	6.18	60.00	5.88	56.58	4.72	57.84	4.47	61.47	7.70	60.29	6.52
12	U1-PTV (mm)	40.16	5.10	41.60	4.91	40.61	7.48	42.15	7.05	44.29	8.50	44.43	7.76
13	U1-PP (mm)	25.70	4.67	23.54	4.35	26.54	1.90	24.10	1.89	27.56	4.25	25.14	3.90
14	Overjet (mm)	4.08	2.67	3.51	1.91	4.00	1.92	3.11	0.94	6.15	2.07	5.07	3.06
15	Overbite (mm)	5.64	1.30	2.65	0.66	5.64	1.18	2.44	0.47	6.64	0.95	2.50	1.38
16	U1 CR To PP (mm)	8.42	2.86	6.44	2.67	9.24	2.94	7.4	2.70	9.89	1.63	7.43	2.13
14	L1-MP (°)	97.50	7.61	100.17	8.04	100.33	7.89	103.33	10.44	98.80	9.28	101.80	9.42

bite.[7–9] The patients selected for this study were those where incisor intrusion was the preferred choice of treatment. However, no overcorrection was carried out and bite opening was to be achieved by intrusion of not only maxillary incisors but also of the mandibular incisors.

The sample in this study was divided randomly into three treatment groups. Depending upon the clinical situation, the intrusion of maxillary and mandibular incisors was carried out. For each method of intrusion, division of sample into maxilla and mandible was essential due to differences in various factors which affects intrusion, such as bone density of maxilla and mandible differs significantly. Also, the surface area of anterior teeth is different. Hence, the optimal force level for intrusion is different for maxilla and mandible. Therefore, the sample was subdivided into maxillary and mandibular arches within each intrusion modality group.

For UIA, an intrusive force was applied to the incisors using tip-back bends at the molars. This tip back bend was

Table 2 – Intragroup comparison of pre- and post-treatment changes in cephalometric skeletal and dental parameters in utility intrusion arch (Group I), Connecticut intrusion arch (Group II), and miniscrew (Group III) for maxillary arch and mandibular arch.

S. No	Variable	Group I (UIA)			Group II (CIA)			Group III (MS)		
		T2–T1			T2–T1			T2–T1		
		Mean	SD	p	Mean	SD	p	Mean	SD	p
1	Sella-nasion (mm)	0.17	0.72	0.557	0.10	0.27	0.36	−0.07	0.19	0.36
2	AFH (mm)	−2.67	3.29	0.075	0.38	1.42	0.51	−0.84	0.95	0.16
3	UFH (mm)	1.17	1.47	0.079	−0.17	1.28	00.74	−0.04	0.43	0.83
4	LFH (mm)	3.97	6.68	0.167	0.75	1.67	0.28	0.80	0.64	0.12
5	PFH (mm)	0.58	1.36	0.302	1.33	1.09	0.02*	0.85	0.67	0.11
6	SNA (°)	−0.14	1.11	0.744	0.71	1.38	0.22	0.07	1.10	0.87
7	SNB (°)	0.50	0.96	0.216	1.14	1.57	0.10	−0.07	0.84	0.83
8	ANB (°)	−0.64	0.85	0.093	−0.43	0.53	0.08	0.14	0.38	0.36
9	MP–FH (°)	0.54	1.41	0.349	1.10	0.74	0.44	−1.14	2.54	0.28
10	MP–SN (°)	1.31	2.49	0.212	1.20	0.90	0.013*	−0.43	2.64	0.682
11	PP–occlusal plane (°)	−0.64	4.33	0.708	1.14	2.79	0.32	−1.64	1.44	0.02*
12	U1-VR (mm)	2.42	0.77	0.00***	1.26	1.09	0.022*	−1.19	2.98	0.333
13	U1-PTV (mm)	1.44	0.52	0.00***	1.54	1.18	0.013*	0.14	2.41	0.697
14	U1-PP (mm)	−2.15	0.51	0.00***	−2.44	0.54	0.00***	−2.41	0.63	0.00***
15	Overjet (mm)	−0.57	0.95	0.165	−0.89	1.46	0.16	−1.08	1.76	0.16
16	Overbite (mm)	−2.99	1.26	0.001***	−3.20	0.77	0.00***	−4.14	1.20	0.00***
17	U1 CR to PP (mm)	−1.98	0.61	.001***	−1.84	0.36	0.00***	−2.46	1.11	0.00***
18	U1-SN (°)	4.29	2.14	0.711	5.71	4.39	0.13	−1.57	5.03	0.44
19	U1-PP (°)	4.00	2.24	0.352	4.71	5.02	0.26	−0.57	5.22	0.782
21	L1-MP (°)	3.833	2.483	0.013*	3.000	3.795	0.111	3.000	5.701	0.305

NS – $p \geq 0.05$ not significant.
* $p \leq 0.05$.
*** $p \leq 0.001$.

Table 3 – Intergroup comparison of pre-treatment and post-treatment changes in cephalometric skeletal and dental parameters in utility intrusion arch (Group I), Connecticut intrusion arch (Group II), and miniscrew (Group III) for maxillary arch and mandibular arch.

S. No.	Variable	Group I vs Group II	Group I vs Group III	Group II vs Group III
1	Sella-nasion (mm)	p = 1.000	p = 1.000	p = 1.000
2	AFH (mm)	p = 1.000	p = 0.379	p = 0.182
3	UFH (mm)	p = 1.000	p = 0.197	p = 0.131
4	LFH (mm)	p = 1.000	p = 0.466	p = 0.449
5	PFH (mm)	p = 1.000	p = 1.000	p = 0.636
6	SNA (°)	p = 0.991	p = 1.000	p = 0.596
7	SNB (°)	p = 0.203	p = 1.000	p = 0.951
8	ANB (°)	p = 0.306	p = 0.088	p = 1.000
9	MP–FH (°)	p = 0.079	p = 0.257	p = 1.000
10	MP–SN (°)	p = 0.525	p = 0.445	p = 1.000
12	U1-PTV (mm)	p = 0.339	p = 0.418	p = 1.000
13	Overjet (mm)	p = 1.000	p = 1.000	p = 0.318
14	Overbite (mm)	p = 0.375	p = 0.196	p = 1.000
15	U1 CR to PP (mm)	p = 0.440	p = 0.774	p = 1.000
16	U1-SN (°)	p = 0.01**	p = 0.043*	p = 1.000
17	L1-MP (°)	p = 1.000	p = 0.003*	p = 0.004**

NS – $p \geq 0.05$ not significant.
* $p \leq 0.05$.
** $p \leq 0.01$.

calibrated, by means of dontrix gauge, so that it exerts 60 g of force on maxillary incisors and 40 g of force on mandibular incisors. Bench et al.[10] advocated the intrusive force of 15–20 g per lower incisor or 60–80 g for all four lower incisors. Ricketts[11] advocated the use of 125–160 g of force for upper incisor intrusion and 60–75 g for lower incisors.

When the vertical skeletal changes (Tweed's MP angle, Steiner's MP angle) were studied, statistically non-significant changes were observed in each treatment modality. The MP angle was reduced slightly in miniscrew group, while it was increased in CIA and utility arch, though was not statistically significant. Statistically significant increase in MP angle (MP–FH) was observed for mandibular intrusion in the CIA (1.58) and UIA (2.25). These observations are in accordance with the study by Varlik et al.[12] who reported similar increase in Steiner's MP angle (SN–MP) with utility arch intrusion.

Similar increase in Steiner's MP angle (SN–MP) was also observed by Amasyali et al. in their study on CIA and utility arch.

In the current study, the anterior facial height, posterior facial height, and the lower facial height increased in CIA and UIA group and not in mini implant group. A more increase was seen for UIA group as compared to CIA group. These findings of CIA and UIA group are in accordance with the previous studies.[13–16] The probable cause of the increase in the facial heights was the slight extrusion of posteriors due to the anchorage taken from them in UIA and CIA. In mini implant group, there was no increase in anterior, posterior facial height and lower facial height. In mini implant group, there was no taxing of anchorage on posteriors in vertical plane, as there was no reciprocal force acting on molars in miniscrews group.

When the intrusion was measured from incisal edge, the maxillary incisor intrusion was 2.41 mm, 2.44 mm, and 2.15 mm for miniscrews, CIA, and UIA respectively. For mandibular incisor, it was 3.84 mm, 2.30 mm, and 2.26 mm for miniscrews, CIA, and UIA respectively. Overbite reduction was 4.14 mm, 3.20 mm, and 2.99 mm for miniscrews, CIA, and UIA respectively. According to Ng et al.,[17] the use of the incisal edge or root apex for the evaluation of intrusion is not recommended because these points do not depend on any change in inclination.

The axial inclination of upper incisors in the present investigation showed a minimum increase during intrusion that was not significant for miniscrew group. The Cr of upper incisors lies 8 mm apical and 5 mm distal to lateral incisors.[16,18] The point of force application in this study was close to the Cr and amount of force applied was within limits. Hence, no moments were generated which happens usually with intrusion arches. In Connecticut and UIA, the axial inclination was more than miniscrew group. These findings are in accordance with McDowell and Baker[19] and DeVincenzo and Winn.[20] Contrary to this, Senısık[21] found more inclination changes in miniscrew group than in CIA. All patients in this study were Class II div 2 malocclusion, so this is the probable reason for proclination of incisors. The results of this study are in accordance with Parker et al.[22] who found an increase in inclination of upper and lower incisors while studying skeletal and dental changes in their study. The study of Karthik[23] also revealed statistically non-significant changes in axial inclination of incisors.

An intrusive force that is labial to the Cr of incisors would intrude them but also tip them labially. Labial tipping tends to decrease overbite because it influences the vertical incisal edge position, and depending on the original inclination of incisors, it can be advantageous in deep bite correction.[24,25] Further research is required to examine the intrusion changes with larger sample size to assess the clinical stability of intrusion in all the patients.

Following conclusions were drawn from this study:

1. All three methods, i.e. miniscrews, CIA, and UIA, were effective methods of intrusion of anterior teeth.
2. True intrusion measured from Cr was maximum in miniscrew group although there was no significant difference between the intrusion achieved by utility arch and Connecticut arch.
3. There was no anchorage loss in miniscrew group while the Cr of maxillary molars was moved mesially which indicated anchorage loss in CIA and UIA group.
4. The change of axial inclination of incisors was minimal in miniscrew group followed by CIA and UIA.
5. Overbite decreased in all the three groups but was more significant for miniscrew group.

Conflicts of interest

The authors have none to declare.

REFERENCES

1. Strang RHW. *A Textbook of Orthodontia*. Philadelphia: Lea & Febiger; 1950.
2. Nanda R, Marzban R, Kuhlberg A. The Connecticut intrusion arch. *J Clin Orthod*. 1998;32:708–715.
3. Kokich VG. Managing complex orthodontic problems: the use of implants for anchorage. *Semin Orthod*. 1996;2: 153–160.
4. Creekmore TD, Eklund MK. The possibility of skeletal anchorage. *J Clin Orthod*. 1983;17:266–269.
5. Polat-Ozsoy O, Arman-Ozcirpici A, Veziroglu F. Miniscrews for upper incisor intrusion. *Eur J Orthod*. 2009;31:412–416.
6. Ricketts RM. Bioprogressive therapy as an answer to orthodontic needs. Part 1. *Am J Orthod*. 1976;70:241–268.
7. Lindauer SJ, Lewis SM, Shroff B. Overbite correction and smile aesthetics. *Semin Orthod*. 2005;11:62–66.
8. Janzen EK. A balanced smile – a most important treatment objective. *Am J Orthod*. 1989;96:275–280.
9. Sarver DM, Ackerman MB. Dynamic smile visualization and quantification and its impact on orthodontic diagnosis and treatment planning. In: Romano R, ed. In: *The Art of the Smile*. New Malden, UK: Quintessence Publishing Co, Ltd.; 2005 :101–139.
10. Bench RW, Gugino CF, Hilgers JJ. Bioprogressive therapy. Part 12. *J Clin Orthod*. 1978;12:569–586.
11. Ricketts RM. Bioprogressive therapy as an answer to orthodontic needs. Part II. *Am J Orthod Dentofac Orthop*. 1976;70:359–397.
12. Varlik SK, Alpakan OO, Turkoz C. Deepbite correction with incisor intrusion in adults: a long-term cephalometric study. *Am J Orthod Dentofac Orthop*. 2013;144:414–419.
13. Steenbergen EV, Burstone CJ, Prahl-Andersen B, Aartman IH. The influence of force magnitude on intrusion of the maxillary segment. *Angle Orthod*. 2005;75:723–729.
14. Al-Buraiki H, Sadowsky C, Schneider B. The effectiveness and long-term stability of overbite correction with incisor intrusion mechanics. *Am J Orthod Dentofac Orthop*. 2005;127:47–55.
15. Julia NG, Major PW, Giseon H, Flores-Mir C. True incisor intrusion attained during orthodontic treatment: a systematic review and meta-analysis. *Am J Orthod Dentofac Orthop*. 2005;128:212–219.
16. Matsui S, Caputo AA, Chaconas SJ, Kiyomura H. Center of resistance of anterior arch segment. *Am J Orthod Dentofac Orthop*. 2000;118:171–178.
17. Ng J, Major PW, Heo G, Flores-Mir C. True incisor intrusion attained during orthodontic treatment: a systematic review and meta-analysis. *Am J Orthod Dentofac Orthop*. 2005;128:212–219.

18. Reimann S. Biomechanical finite element investigation of the position of the centre of resistance of upper incisors. *Eur J Orthod*. 2007;29:219–224.
19. McDowell EH, Baker IM. The skeletodental adaptations in deep bite correction. *Am J Orthod Dentofac Orthop*. 1991;100:370–375.
20. DeVincenzo JP, Winn MW. Maxillary incisor intrusion and facial growth. *Angle Orthod*. 1987;57:279–289.
21. Senısık NE, Turkkahraman H. Treatment effects of intrusion arches and mini-implant systems in deepbite patients. *Am J Orthod Dentofac Orthop*. 2012;141:723–733.
22. Parker CD, Nanda RS, Currier GF. Skeletal and dental changes associated with the treatment of deep bite malocclusion. *Am J Orthod Dentofac Orthop*. 1995;107:382–393.
23. Karthik J, Jayakumar P. The Connecticut intrusion arch. *J Ind Orthod Soc*. 2002;35:187–194.
24. Ricketts RM, Bench RW, Gugino CF, et al. *Bioprogressive Therapy. Book 1*. Denver, CO: Rocky Mountain Orthodontics; 1978
25. Sameshima GT, Sinclair MP. Predicting and preventing root resorption. Part 2. Treatment factors. *Am J Orthod Dentofac Orthop*. 2001;119:511–515.

Dr. Lt. Gen Tapas Kumar Bandyopadhyay takes over as DGDS and Colonel Commandant ADC



DR-10358M Lt. Gen. Tapas Kumar Bandyopadhyay took over the reigns of Army Dental Corps on 23rd March, 2015 when he assumed the appointment of Director General of Dental Services (DGDS) and Colonel Commandant, Army Dental Corps. He has been appointed as the President Honorary Dental Surgeon (PHDS).

The General Officer donned the uniform on 30th September, 1982 after graduating from Dr. R. Ahmed Dental College and Hospital, Calcutta University in 1981. He completed MDS in Oral and Maxillofacial Surgery from AFMC Pune in 1990.

During his illustrious service career, spanning over 32 years, the General Officer has held various coveted appointments. He has served as Direct and Dental Advisor (Navy) at Naval Institute of Dental Sciences, Mumbai, Commandant and Command Dental Advisor at Command Military Dental Centre, Southern Command.

We are confident that the Army Dental Corps shall touch new heights in the field of oral and maxillofacial dentistry and oral health in general and advance further the research activities of Army Dental Corps.

He was awarded the **VishistSeva Medal in 2016, is the President of IDA Defence Branch and Chief Editor of** Journal of Dentistry Defence Section.

He has a number of scientific publications to his credit.

Our heartiest congratulatiosn to Lt. Gen. Tapas Kumar Bandyopadhyay.